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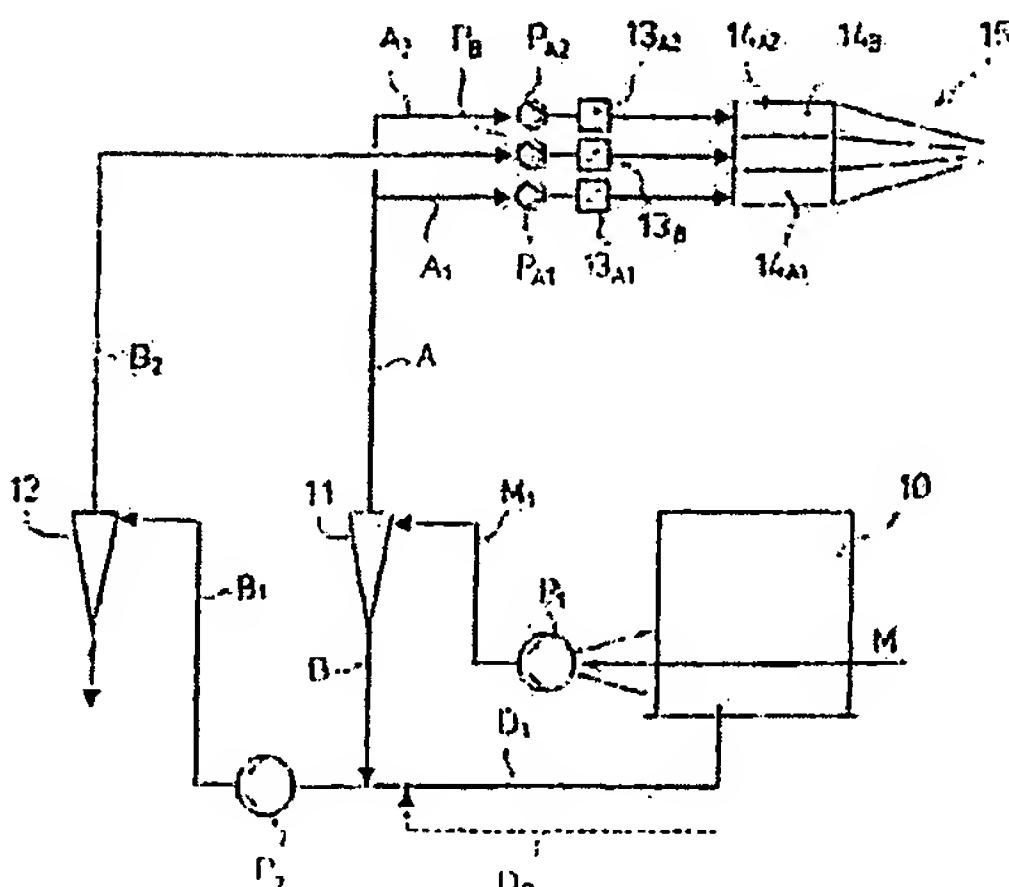
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(54) Title: METHOD FOR MAKING A LAYERED PAPER OR BOARD WEB



(57) Abstract: A method for manufacturing a layered paper or board web, in which method thick stock (M) delivered to the paper machine is diluted with tail water and the diluted stock ( $M_1$ ) is fractionated in order to produce two different stock fractions (A,B). The first stock fraction (A), which contains on an average finer material than the second stock fraction (B), is conducted into the surface layer or layers of the paper or board web, and the second stock fraction (B), which contains on an average coarser material than the first stock fraction (A), is conducted into the middle layer or layers of the paper or board web. Before feeding into a headbox (15), the coarse stock fraction (B) from fractionation is diluted with water whose consistency is substantially lower than the consistency of the water added into the thick stock (M) before fractionating. When water, which contains less solids from the stock than the normal tail water, is used to dilute the coarse stock fraction, the stock fractions used for different layers of the paper or board web can, better than before, maintain their different properties, which improves the result of layering in paper or board manufacturing.

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## Method for Making a Layered Paper or Board Web

- 5 The invention relates to a method for making a layered paper or board web, in which method thick stock delivered to a paper machine is diluted with tail water and the diluted stock is fractionated to produce two different stock fractions of which, the first stock fraction, containing on an average finer material than the second stock fraction, is conducted into the surface layer or layers of the paper or board web, and  
10 the second stock fraction, containing on an average coarser material than the first stock fraction, is conducted into the middle layer or layers of the paper or board web.

A stock feed system for a multi-layer headbox is disclosed in the US patent No. 5,746,889, in which different stock concepts are produced out of the same fresh stock  
15 to be fed into different layers of the multi-layer headbox. The stock feed system contains at least one screen for transferring long fibers out of the stock that is destined to form the surface layer of the paper into the stock that is destined to form a layer placed in the interior of the paper. The system may also contain another screen for transferring short fibers out of the stock that is destined to form the layer placed in the  
20 interior of the paper into the stock that is destined to form the surface layer of the paper.

Fractionating methods that apply centrifugal cleaning are disclosed in WO published applications Nos. 0 129 311 A1 and 0 222 947 A1, in which accept from the first  
25 centrifugal cleaning step is transferred into the surface layers of the web to be formed, and the accept from a second or lower step is transferred into the middle layers of the web to be formed. By fractionating the stock, lower fines contents and higher average fiber length can be achieved in the middle layers of the web than in the surface layers of the web. On the other hand, higher fines and filler contents can be achieved in the

surface layers of the web than in the middle layers, which, among other things, improves the printing properties of the paper.

- The accept fibers separated during the fractionating of the stock are on an average shorter, thinner and more pliable, and the accept contains more fines and filler than the reject. For simplicity's sake, the accept from fractionation will be referred to as the fine stock fraction and the reject from fractionation will be referred to as the coarse stock fraction.
- 5 It is typical for fractionating that the consistency of the accept is decreased and the consistency of the reject is increased compared to the consistency of the feed. Because of this, the reject often has to be diluted before it can be conducted into the headbox of the paper machine. In WO 0 222 947, the rejects from the fractionating stages are diluted with tail water taken from a wire pit before they are transferred into 10 the next stage. In WO 0 129 311, the same tail water is being used for diluting both the accept and the reject before they are fed into the different layers of the multi-layer headbox. When the coarse stock fraction intended for the middle layers of the web is diluted with "impure" tail water, i.e. containing plenty of fines and filler, at least some of the advantages obtained with fractionating are lost. Because of the tail water, 15 the drainability of the reject can go down almost to the level of the accept and the filler content can go up to near the filler content of the accept.
- 20

The object of the invention is to provide an improved method for manufacturing a web from a stock by layering the different fractions thereof. Especially, the object is 25 to maintain the different properties of the stock fractions produced by fractionating, whereupon the objectives set for the layering of the stock are easier to reach.

In order to obtain these and other objects that will become evident later, the method according to the invention is characterized by what is defined in the characterizing

part of claim 1.

When the coarse stock fraction is diluted with water that contains less solids originating from the stock than normal tail water, the different properties of the stock 5 fractions used for different layers of the paper or board web can be maintained better than before, which improves the result of layering in paper or board manufacturing.

Tail water is a filtrate removed from the web being formed on the wire section, which 10 water is collected into a wire pit or the like and which contains fines and filler originating from the paper stock. A major part of the solids contained in the primary tail water is returned into the process by using tail water for diluting the thick stock in the short circulation of the paper machine.

Water suitable for diluting the coarse stock fraction is characterized by the fact that 15 the consistency of the water is substantially lower than the consistency of the tail water used for diluting the thick stock before fractionating. Preferably, the consistency of the diluting water is less than 60 % of the consistency of the primary tail water.

20 Examples of possible water fractions suitable for diluting the reject are cloudy and clear filtrate from the recovery of fibers, water coming from suction flatboxes, separately collected paper machine spray water, water coming from the press section and tail water fractioned by clarification or some other method. One option is to dilute tail water with a substantially cleaner water fraction such that the consistency 25 of water used for diluting the coarse stock fraction is substantially lower than the original consistency of the tail water.

In the following, the invention will be described with reference to the examples in the appended figures, but the intention is not to limit the invention to these only.

Figure 1 shows a schematic view of manufacturing of layered paper using fractionating of the stock and a multi-layer headbox.

Figure 2 shows manufacture of a multi-layer web using fractionating of the stock and  
5 two different web-forming units.

According to figure 1, thick stock M is delivered into the paper machine via a wire pit  
10, where it is diluted with tail water originating from the wire section. The diluted  
stock M<sub>1</sub> is conducted with a pump P<sub>1</sub> into a first centrifugal cleaning step 11 of a  
10 centrifugal cleaner equipment, where the stock is fractionated into two stock fractions  
A and B. Fractionating is performed so, that the first stock fraction will contain fibers  
that on an average are thinner, shorter and more pliable and also more fines and filler  
than the second stock fraction B. Because of this, the stock fractions are in the  
following referred to as the fine stock fraction A and the coarse stock fraction B.  
15

The fine stock fraction A from fractionation is conducted as two component flows A<sub>1</sub>  
and A<sub>2</sub> through pumps P<sub>A1</sub> and P<sub>A2</sub> and machine screens 13<sub>A1</sub> and 13<sub>A2</sub> into two  
layers 14<sub>A1</sub> and 14<sub>A2</sub> of a multi-layer headbox 15 that are used to form the top and  
bottom layers of the manufactured paper or board web.  
20

The coarse stock fraction B from fractionation is diluted and the diluted stock flow B<sub>1</sub>  
is conducted through a pump P<sub>2</sub> into a second centrifugal cleaning step 12 of the  
centrifugal cleaner equipment, where impurities are extracted from the stock. The  
accept B<sub>2</sub> from the centrifugal cleaning step 12 is conducted through a pump P<sub>B</sub> and a  
25 machine screen 13<sub>B</sub> into a layer 14<sub>B</sub> of the multi-layer headbox that is used for  
forming the middle layer of the paper and board web.

As the fractionating increases the consistency of the coarse stock fraction B, the stock  
B must be diluted before conducting it into the headbox 15. Conventionally, tail

water  $D_1$  taken from the wire pit 10, containing substantial amount of fibers, fines and filler, is used for dilution. In the solution according to the invention, a water flow  $D_0$ , whose consistency is lower than the consistency of the tail water  $D_1$  taken from the wire pit 10, is conducted into diluting the coarse stock fraction B. This water can, for 5 example, be taken from fiber recovery screen, spray water recovery or from suction flatboxes. Also water from the wire pit 10 can be used as dilution water, provided that enough solids have been extracted from it in a separate process stage (not shown). Dilution water, which is substantially cleaner than the tail water, can also be obtained by diluting water from the wire pit with a cleaner water fraction.

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Figure 2 illustrates another solution according to the invention. There, the diluted stock  $M_1$  is fractionated in the first centrifugal cleaning step 11 of the centrifugal cleaner equipment into two stock fractions A and B. The fine stock fraction A from fractionation is conducted into a headbox 16, which feeds the stock on a fourdrinier wire 18 for forming a first web  $W_1$ . The coarse stock fraction B from fractionation is diluted with a water flow  $D_0$ , whose consistency is lower than that of the tail water  $D_1$  from the wire pit 10, and it is conducted into a second centrifugal cleaning step 12 of the centrifugal cleaner equipment. The cleaned stock  $B_2$  is conducted through a pump 15  $P_B$  and a machine screen 13<sub>B</sub> into a headbox 17, which feeds the stock on a second fourdrinier wire 19 for forming a second web  $W_2$ . The second web  $W_2$  is carried by 20 the wire 19 on top of the first web  $W_1$  on the wire 18 and the webs  $W_1$  and  $W_2$  are joined together to form a two-layered board web.

25

When manufacturing multi-layer web, there naturally can be more than two separate web forming units and the web forming units may comprise besides a fourdrinier wire also a gap former.

Instead of the above-described centrifugal cleaning device, fractionation can also be carried out in a manner known per se by using pressure screens. By adapting the

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fractionating techniques and the reject ratio, different types of properties can be obtained for the different layers of the web. There can naturally be more than one fractionating stage.

- 5 In the following the patent claims will be given, and the details of the invention may show variation within the scope of the inventive idea defined in said claims and differ from the details given above for the sake of example only.

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## Claims

1. A method for manufacturing a layered paper or board web, in which method thick stock (M) delivered to a paper machine is diluted with tail water and the diluted stock (M<sub>1</sub>) is fractionated to produce two different stock fractions (A, B), of which the first stock fraction (A), containing on an average finer material than the second stock fraction (B), is conducted into the surface layer or layers of the paper or board web, and the second stock fraction (B), containing on an average coarser material than the first stock fraction (A), is conducted into the middle layer or layers of the paper or board web, **characterized** in that the coarse stock fraction (B) is, before being fed into a headbox (15; 17), diluted with water having a consistency that is substantially lower than the consistency of the tail water added into thick stock (M) before fractionating.
- 15 2. A method according to claim 1, **characterized** in that the coarse stock fraction (B) from fractionation is diluted with water, whose consistency is at the most 60 % of the consistency of the tail water used for diluting the stock before fractionating.
- 20 3. A method according to any of the preceding claims, **characterized** in that water from fiber recovery, suction flatboxes and/or press section and/or separately collected fabric conditioning water and/or cleaned tail water is/are used for diluting the coarse stock fraction (B) from fractionation.
- 25 4. A method according to any of the preceding claims, **characterized** in that tail water that has been diluted with a water type substantially cleaner than the tail water itself is used for diluting the coarse stock fraction (B) from fractionation.
5. A method according to any of the preceding claims, **characterized** in that the coarse stock fraction (B) from fractionation is conducted into the headbox (15; 17)

through a cleaning device (12) and that the stock fraction (B) in question is diluted before it is fed into said cleaning device (12).

6. A method according to any of the preceding claims, **characterized** in that  
5 fractionating is carried out by centrifugal cleaners (11).
7. A method according to any of the preceding claims, **characterized** in that fractionating is carried out by screens.
- 10 8. A method according to any of the preceding claims, **characterized** in that fractionating is carried out by in two or more stages.
- 15 9. A method according to any of the preceding claims, **characterized** in that the fine stock fraction (A) from fractionation is conducted into at least one layer ( $14_{A1}$ ,  $14_{A2}$ ) of the multi-layer headbox (15) used for forming a surface layer of the paper or board web, and the coarse stock fraction (B) from fractionation is conducted into at least one other layer ( $14_B$ ) of the same multi-layer headbox (15) used for forming a middle layer of the paper or board web.
- 20 10. A method according to any one of claims 1 to 8, **characterized** in that the fine stock fraction (A) from fractionation is conducted into at least one headbox (16) used for forming a surface layer of the multi-layer web, and the coarse stock fraction (B) from fractionation is conducted into at least one other headbox (17) used for forming a middle layer of the multi-layer web.

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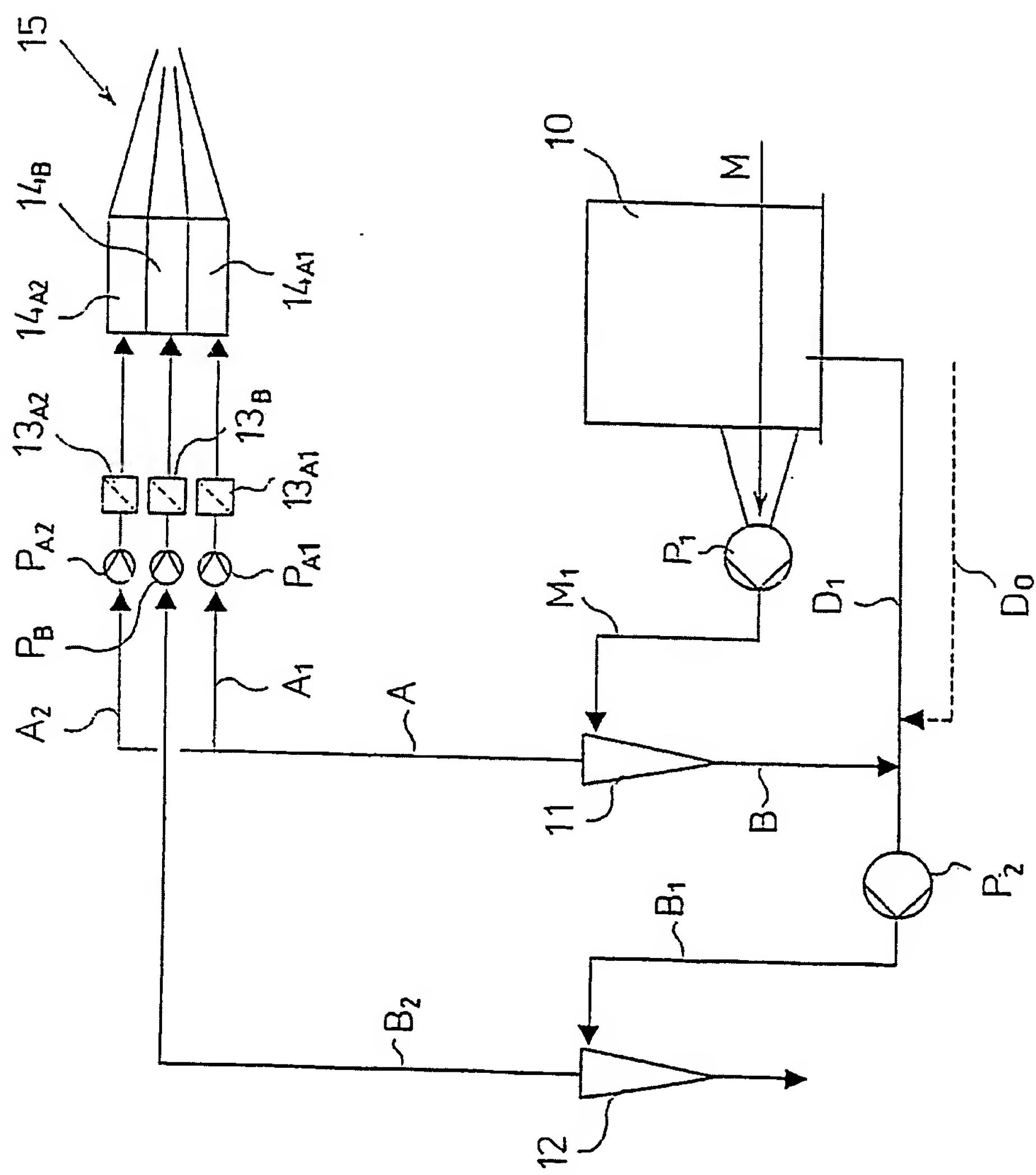


FIG. 1

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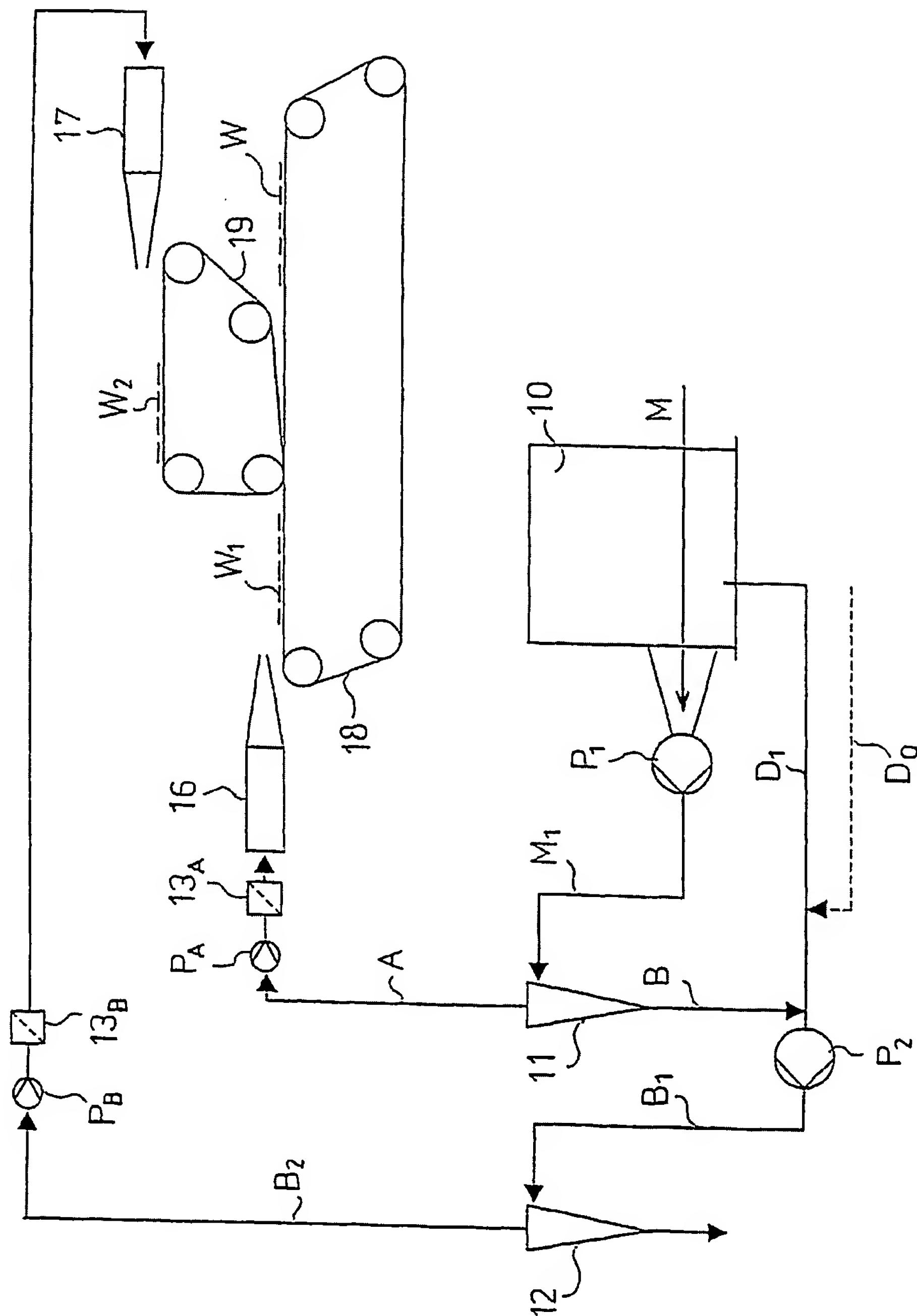


FIG. 2

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/FI 2004/000549

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC7: D21F 1/66**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: D21F**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE, DK, FI, NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6210529 B1 (TAISTO HUTELIN), 3 April 2001 (03.04.2001), claim 1, abstract  --	1-10
A	US 6267845 B1 (JOUKO HAUTALA ET AL), 31 July 2001 (31.07.2001), claims 1,2, abstract  --	1-10
A	WO 02086233 A1 (METSO PAPER, INC.), 31 October 2002 (31.10.2002), claims 1,2, abstract  -- -----	1-10

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

27/11/2004

International application No.
PCT/FI 2004/000549

US	6210529	B1	03/04/2001	AT 259907 T 15/03/2004 AU 4620099 A 30/12/1999 CA 2334706 A 16/12/1999 DE 19926111 A,C 16/12/1999 DE 69914919 D 00/00/0000 EP 1102888 A,B 30/05/2001 SE 1102888 T3 FI 103677 B 00/00/0000 FI 981328 D 00/00/0000 JP 2002517636 T 18/06/2002 WO 9964669 A 16/12/1999
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